We claim:

1. A matching and tuning network for connecting a source of RF power to a complex load, the network comprising:

a primary circuit comprising an adjustable tuning capacitor connected in series with a primary winding of a pair of mutually coupled coils adapted to connect to a source of RF power;

a secondary circuit comprising a series connection of a secondary winding of said pair of mutually coupled coils and a fixed capacitor connected to an input of a transformer; and

a tertiary circuit comprising a connection of an output of the transformer and an input of a tapped loading coil connected to said load;

the matching and tuning network further comprises:

input voltage sensing means;

input current sensing means;

impedance detector means connected to both said input voltage sensing means and said input current sensing means;

a phase detector means; and

antenna current sensing means;

wherein the impedance detector means controls means for varying the coupling between said primary winding and said secondary winding of said pair of mutually coupled coils, said phase detector means controls means for varying the inductance of the tapped loading coil so as to maintain a constant input impedance and a zero phase angle at the input to the network and said antenna current sensing means controls means for varying the output power level of the

source of RF power.

2. The matching and tuning network according to claim 1, wherein the tapped loading coil comprises a pair of cylindrically oppositely wound coils mounted side by side.

3. The matching and tuning network according to claim 1, wherein the impedance detector is connected to a first bi-directional motor to vary the coupling of the pair of mutually coupled coils.

4. The matching and tuning network according to claim 3, wherein the phase detector is connected to a second bi-directional motor to vary the inductance of said tapped loading coil.

5. The matching and tuning network according to claim 3, wherein the coupling of the pair of mutually coupled coils is varied by moving the secondary winding relative to the primary winding which is fixed.

6. The matching and tuning network according to claim 4, wherein the inductance of said tapped loading coil is varied by moving a first metallic slug in or out of one of said cylindrically oppositely wound coils and a second metallic slug in or out of the other one of said cylindrically oppositely wound coils.

7. The matching and tuning network according to claim 4, wherein the inductance of said tapped loading coil is varied by moving a metallic slug in or out of one of said cylindrically oppositely wound coils.

8. The matching and tuning network according to claim 6, wherein said first and second metallic slugs is comprised of ferrite.

9. The matching and tuning network according to claim 7, wherein said metallic slug is comprised of copper.

10. The matching and tuning network according to claim 1, wherein the voltage sensing

means is located at the RF power source and the input current detector means and phase detector means are located in series in the primary circuit, between the source of RF power and the variable tuning capacitor.

11. The matching and tuning network according to claim 1, wherein the transformer has a plurality of fixed tapping positions, one of which may be selected to present a desired impedance value at the secondary winding of said mutually coupled coils.

12. The matching and tuning network according to claim 1, wherein the transformer further comprises a dc path to ground for the antenna.

13. The matching and tuning network according to claim 2, wherein the pair of cylindrically oppositely wound coils have a plurality of fixed tapping positions, wherein a position on each of said cylindrically oppositely wound coils is selected and are connected so as to resonate the capacitance of the complex load.

14. The matching and tuning network according to claim 13, wherein said pair of cylindrically oppositely wound coils are connected in parallel or in series, providing a wide selection of capacitance values.

15. The matching and tuning network according to claim 1 further comprising:

a power detector means connected to said voltage detector means and said input current detector means;

a selector switch connected to said power detector means, said antenna current detector means, and a front panel meter;

wherein said power detector means output a forward power value and a reflected power value to said selector switch and said antenna current means outputs an antenna current value to said selector switch;

and wherein said selector switch may be positioned in one of a plurality of positions; one of

said plurality of positions resulting in the display of said forward power value on said front panel meter, another of said plurality of positions resulting in the display of said reflected power value on said front panel meter, another of said plurality of positions resulting in the display of said antenna current value on said front panel meter and yet another of said plurality of positions resulting in the display of said antenna current value on said front panel meter on a second, linear scale.

16. The matching and tuning network according to claim 1, wherein said variable tuning capacitor comprises an array of six fixed high power capacitors which are selectively connected in parallel to resonate the inductance of the primary winding of said pair of mutually coupled coils.

17. A control circuit for controlling a matching and tuning network according to claim 4, the control circuit comprising:

a first microcontroller and a second microcontroller electrically connected to one another;

a first control signal representative of the input voltage of the source of RF power output by said voltage detector means and input to said first microcontroller;

a second control signal representative of the input current of the source of RF power output by said input current detector means and input to said first microcontroller;

a third control signal representative of a situation where the input voltage leads the input current of the source of RF power and input to said first microcontroller;

a fourth control signal representative of a situation where the input voltage lags the input current of the source of RF power and input to said first microcontroller; and

a fifthcontrol signal representative of the antenna current output by said antenna current detector means and input to said first microcontroller and passed to said second microcontroller via said serial link, wherein:

said first microcontroller receives and compares said first and said second control signals and generates a sixth control signal to control the means for varying the coupling between said primary winding and said secondary winding of said pair of mutually coupled coils;

said first microcontroller receives said third and fourth control signals and generates a seventh control signal to control means for varying the inductance of the tapped loading coil; and

said second microcontroller generates an eighth control signal to control the output power level of said source of RF power.

18. The control circuit according to claim17, wherein said first microcontroller and said second microcontroller are connected via a serial link.

19. The control circuit according to claim17, wherein said first microcontroller and said second microcontroller are connected via a network.

20. The control circuit according to claim17, further comprising a plurality of momentary action switches, each connected to said first microcontroller, wherein:

a first momentary action switches toggles functional control of said first microcontroller between a local and a remote location;

a second momentary action switches toggles the inhibition of activation of said first bi-directional motor;

a third momentary action switches toggles the inhibition of activation of said second bi-directional motor;

a fourth momentary action switches toggles the ignoring of said first and second control signals and instructs said first microcontroller to control said first bi-directional motor in the direction to decrease the coupling between said primary winding and said secondary winding of said pair of mutually coupled coils;

a fifth momentary action switches toggles the ignoring of said first and second control signals and instructs said first microcontroller to control said first bi-directional motor in the direction to increase the coupling between said primary winding and said secondary winding of said pair of mutually coupled coils coil;

a sixth momentary action switches toggles the ignoring of said third and fourth control signals and instructs said first microcontroller to control said second bi-directional motor in the direction to decrease the inductance of said tapped loading coil; and

a seventh momentary action switches toggles the ignoring of said third and fourth control signals and instructs said first microcontroller to control said second bi-directional motor in the direction to increase the inductance of said tapped loading coil.

21. The control circuit according to claim17, further comprising a plurality of front panel indicators, each connected to said first microcontroller, wherein:

a first front panel indicator indicates local functional control of said microcontroller;

a second front panel indicator indicates remote functional control of said microcontroller;

a third front panel indicator indicates inhibition of activation of said first bi-directional motor;

a fourth front panel indicator indicates inhibition of activation of said second bi-directional motor;

a fifth front panel indicator indicates a situation where said first and second control signals are equal;

a sixth front panel indicator indicates a situation where said first control signal is greater than second control signals;

a seventh front panel indicator indicates a situation where said first control signal is lower than second control signals;

an eighth front panel indicator indicates a situation where said third control signal is active;

a ninth front panel indicator indicates a situation where said fourth control signal is active; and

a tenth front panel indicator indicates a situation where said third and fourth control signals are inactive.

22. The control circuit according to claim18, further comprising a plurality of front panel indicators, each connected to said first microcontroller, wherein:

a first front panel indicator indicates local functional control of said microcontroller;

a second front panel indicator indicates remote functional control of said microcontroller;

a third front panel indicator indicates inhibition of activation of said first bi-directional motor;

a fourth front panel indicator indicates inhibition of activation of said second bi-directional motor;

a fifth front panel indicator indicates a situation where said first and second control signals are equal;

a sixth front panel indicator indicates a situation where said first control signal is greater than second control signals;

a seventh front panel indicator indicates a situation where said first control signal is lower than second control signals;

an eighth front panel indicator indicates a situation where said third control signal is active;

a ninth front panel indicator indicates a situation where said fourth control signal is active; and

a tenth front panel indicator indicates a situation where said third and fourth control signals are inactive.

23. The control circuit according to claim18, wherein said remote functional control is controlled by said second microcontroller rendering said second to seventh momentary action switches inoperable.

24. The control circuit according to claim18, wherein said local functional control is controlled by said first microcontroller rendering said second to seventh momentary action switches operable.

25. The control circuit according to claim18, wherein said remote location is a location shared by said source of RF power.

26. The control circuit according to claim19, wherein said remote location is a terminal connected to the Internet.